PB90-157751

Superfund Record of Decision (EPA Region 7)
Hastings Groundwater, Hasting, NE
(First Remedial Action), September 1989

(U.S.) Environmental Protection Agency, Washington, DC

26 Sep 89

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Environmental Protection
Agency

Office of
Emergency and
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EPA/ROD/R07-89/029
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Superfund Record of Decision:

Hastings Groundwater, NE

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Hastings Ground Water Contamination site is a contaminated aquifer in the vicinity of the city of Hastings, Adams County, Nebraska. The site consists of several source areas, referred to as subsites, contaminated with various chlorinated volatile industrial chemicals. This Record of Decision addresses the Well Number 3 subsite which consists of a ground water plume contaminated with carbon tetrachloride emanating from a former grain storage facility. The State first identified volatile organic contamination in Well Number 3 in 1983. Between 1986 to 1989 EPA conducted a field investigation which identified the grain storage area as the source of ground water contamination probably resulting from accidental spills of liquid fumigants used during grain storage. This interim source control operable unit was developed to reduce the migration and volume of volatile contaminants present in the soil. The primary contaminants of concern in the soil which impact the ground water are VOCs including carbon tetrachloride and chloroform.

The selected remedial action for this site includes utilization of in-situ soil vapor extraction to remove approximately 400 pounds of VOCs from the soil; treatment of vapor emissions by a vapor phase granular activated carbon system; and replacement of spent
(See Attached Sheet)

17. Document Analysis a. Descriptors

Record of Decision - Hastings Ground Water Contamination, NE
First Remedial Action
Contaminated Media: soil
Key Contaminants: VOCs (carbon tetrachloride)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 33
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) See Instructions on Reverse OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

16. Abstract (Continued)

granulated activated carbon filters followed by offsite disposal at an approved treatment facility for regeneration or incineration. The estimated capital cost for this remedial action is $874,000 with an annual O&M of $154,000.

The major components of the selected action are as follows:

- Soil vapor extraction (SVE) and treatment of air emissions by granular activated carbon (GAC)
- GAC will be transported off-site to an approved treatment facility for regeneration or incineration
- Monitoring contaminants in the soils above the aquifer;
- Monitoring ground water contamination at the site; and
- Monitoring of the air system emissions.

DECLARATION

This interim action is protective of human health and the environment, attains federal and state requirements that are applicable or relevant and appropriate to this action and is cost-effective. This action satisfies the statutory preference for actions that employ treatment that reduces toxicity, mobility or volume as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. This action will mitigate future releases to the ground water; however, this action will not address other contaminant source areas. Due to its limited scope of migration control, this action does not address remediation of the ground water. Subsequent remediations are planned for the site that will address all remaining concerns.

9-26-89
Date

Morris Kay
Regional Administrator

Attachments: Index to Administrative Record
Decision Summary
Responsiveness Summary

RECORD OF DECISION DECLARATION
INTERIM SOURCE CONTROL OPERABLE UNIT

SITE NAME AND LOCATION

Well Number 3
Hastings Ground Water Contamination
Hastings, Nebraska

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected response action for the Well Number 3 subsite developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 USC §9601 et. seq. and consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) to the extent practicable.

This decision is based upon the contents of the administrative record for the Well Number 3 subsite.

In accordance with CERCLA Section 121(f)(1)(E) and (G), the state of Nebraska reviewed and commented on the Engineering Evaluation and Cost Analysis for an Expedited Response Action for Soil and Soil Gas (EE/CA) Well Number 3 Subsite. The state concurs in the selected action for this operable unit and has determined, through a detailed evaluation, that the selected action is consistent with its laws and regulations.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare or the environment.

DESCRIPTION OF THE ACTION

This interim source control operable unit was developed to protect public health and the environment by controlling and reducing the migration and volume of contaminants present in the soil-gas which overlies the aquifer. The operable unit is fully consistent with all planned future activities. Future activities will be addressed in subsequent Records of Decision and will include a decision on possible remediation of contaminated ground water.

RECORD OF DECISION

DECISION SUMMARY

HASTINGS GROUND WATER CONTAMINATION

WELL NUMBER 3

HASTINGS, NEBRASKA

Prepared By:

U.S. Environmental Protection Agency

Region VII

Kansas City, Kansas

September, 1989

Record of Decision

Decision Summary

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DECISION SUMMARY
WELL NUMBER 3 SUBSITE
HASTINGS GROUND WATER CONTAMINATION

SITE DESCRIPTION

The Hastings Ground Water Contamination site is located in south central (Adams County) Nebraska. The location of Adams County and Hastings is shown by Figure 1. Hastings has an estimated population of 23,000. This site consists of several source areas which are referred to as "subsites." These subsites are identified with various volatile industrial chemicals. The Well Number 3 subsite consists of a carbon tetrachloride ground water plume which extends eastward from a former grain storage facility. This subsite is located in the west central part of Hastings. The affected area lies between B Street and Second Street in the north-south direction, and between Maple Avenue and Kansas Avenue in the east-west direction (see Figure 2).

The Well Number 3 Subsite is located in the Central Industrial Area of the city which contains commercial and industrial properties situated along the Burlington-Northern Railroad right-of-way. Well Number 3 source area is located on property that was formerly used as a grain storage facility. Records indicate that the property was previously owned by the Burlington Northern Railroad. In 1959, the property was leased by the railroad to Farmers Grain Storage, Inc., and later, in 1972, purchased by Farmers Grain Storage, Inc. The current owner, W.G. Pauley Lumber Co., purchased the property in 1975.

Hastings Public Water Supply Well Number 6 is located four blocks west of the source area. Well Number 11 is located four blocks north-east of the source area. Wells Number 9, 10 and 20 are all downgradient of this site. Well Number 3 is one mile downgradient from the identified source area. This well was taken out of service in 1985. The municipal wells, shown on Figure 2, were sampled by the state of Nebraska; the data are presented in Table 1.

SITE HISTORY

The Hastings Groundwater Contamination site consists of an aquifer contaminated with industrial chemicals, primarily chlorinated volatile organics. Due to this contamination, the City of Hastings decommissioned several of its wells and the CMS public supply system operating east of Hastings decommissioned one well.

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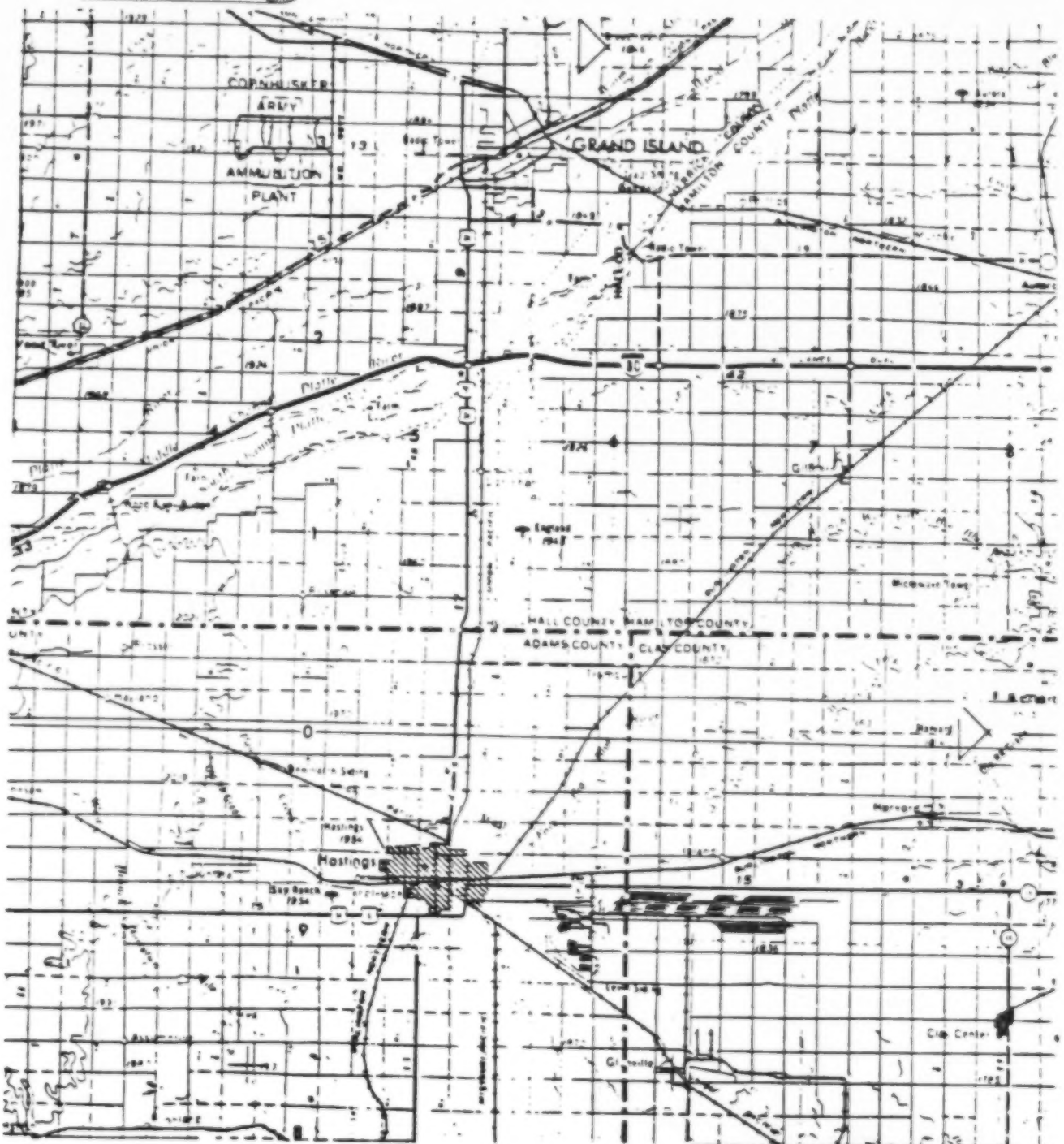


Site Location Map
HASTINGS, NEBRASKA

0 5 Miles
Scale

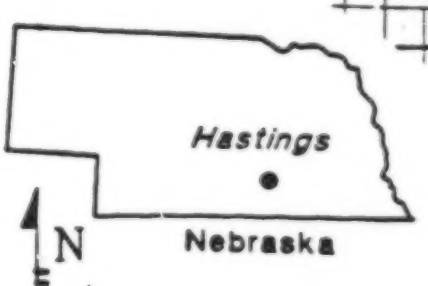


Figure 1

WELL LOCATIONS WELL #3 AREA

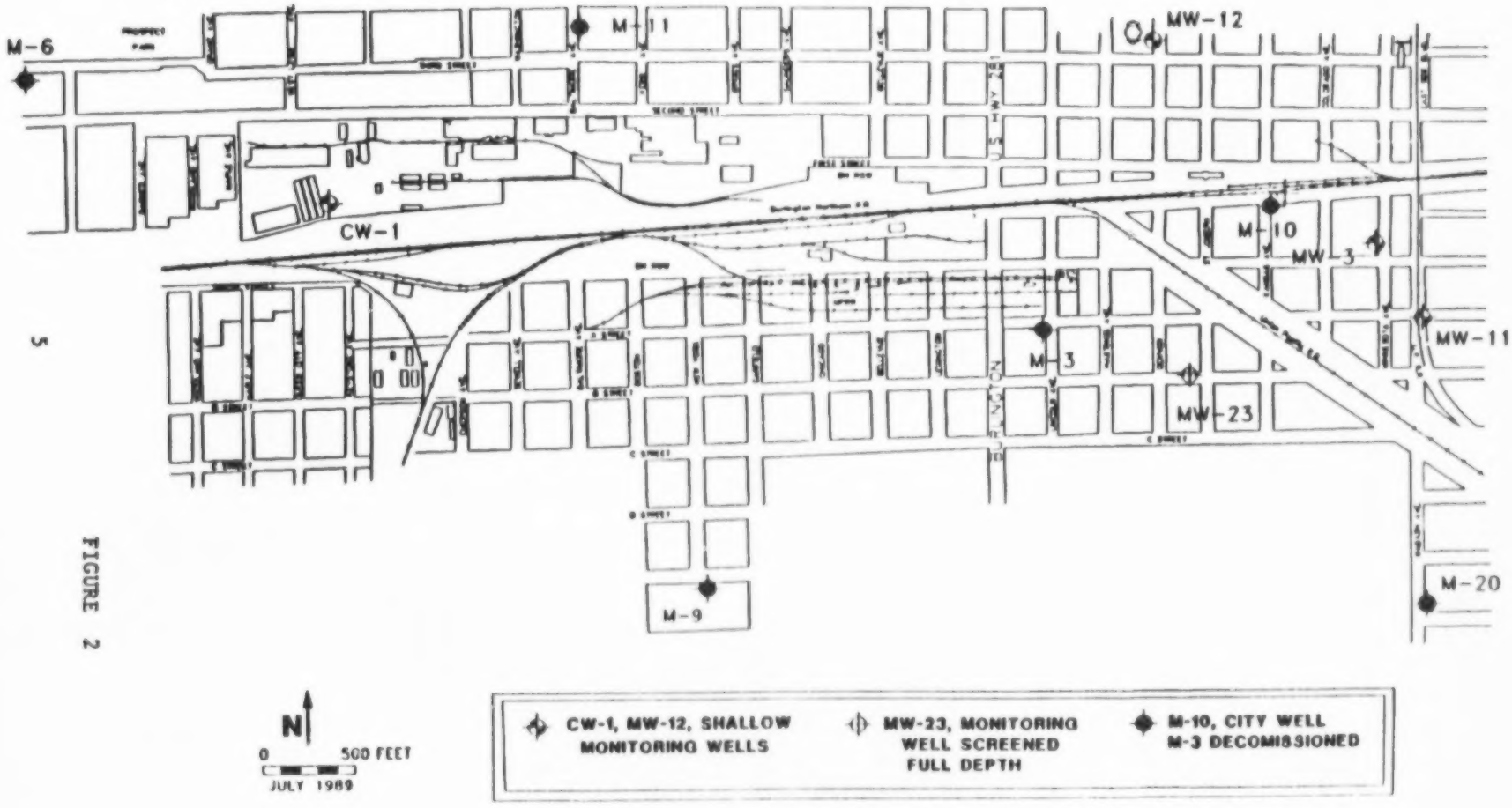


FIGURE 2

TABLE 1
Range of Concentrations of Volatile Organic Compounds
City of Hastings, Nebraska.
1983 - 1984
Municipal Wells
Concentrations in micrograms per liter (ug/l).

PARAMETER	M-3	M-6	M-9	M-10	M-11
Carbon Tetrachloride (CCl_4)	27.1 - 46.4	NA	ND	ND	NA
Chloroform	ND	ND	ND	ND	0.15
1,1-Dichloroethene (DCE)	ND	NA	ND	ND	NA
Trans-1,2-Dichloroethene	ND	NA	ND	ND	NA
Tetrachloroethene (PCE)	ND	NA	ND	ND	NA
Trichloroethylene (TCE)	ND	ND	ND	19.6 - 46.5	0.42
1,1,1-Trichloroethane (TCA)	ND	NA	ND	ND	NA
Ethylene Dibromide (EDB)	ND	NA	NA	ND	NA

Notes

- Ground water data (1983-1984) presented here reflect data from two wells (M-3 and M-10) which have since been taken out of regular service and/or disconnected from the distribution system. The highest contaminant concentrations were found in 1983 when the wells were in use.
- Data was obtained from state of Nebraska data reports and the REM II - Ground Water Evaluation, Hastings Groundwater contamination Site, Hastings, Nebraska, May 7, 1987.
- Samples analyzed by EPA's Lab in September, 1984 were consistent with the above data.
- NA - parameter not analyzed.
  ND - compound not detected.
- 1983 and 1984 analyses were reported by the state of Nebraska.

In 1983, the Nebraska Department of Health (NDOH) sampled the public water supply system of Hastings in response to citizen complaints of taste and color in the drinking water. That same year, NDOH and the Nebraska Department of Environmental Control (NDEC) began investigating wide-spread ground water contamination in the Hastings area. During this investigation, samples collected from Well Number 3 indicated that the well was contaminated with carbon tetrachloride (CCl_4).

In 1984, the state of Nebraska installed five pairs of monitoring wells in the City of Hastings to define the extent of the contamination. The Environmental Protection Agency (EPA) began to sample wells on a quarterly basis in 1985. Results of the production wells are given in Table 2.

Several locations on the west side of Hastings upgradient of City Well 3 were suspected as source areas for the CCl_4 contamination. Between 1986 and 1989 EPA performed a field investigation to identify and characterize these suspected source areas. Analyses of soil gas samples were used to identify and define the source areas. The results of the data, which are presented in the EE/CA, indicated that the former grain storage facility was the area from which the CCl_4 found in Well Number 3 emanated. No other sources of contamination were indicated by the data. Results of the soil-gas sampling taken from depths of 20 to 22 feet at the Well Number 3 subsite are shown in Figure 3. These results indicate the CCl_4 source is located in an area at the east corner of the old grain storage building.

The contamination found in the water at the Well Number 3 subsite is believed to be a result of accidental spills of grain fumigants that occurred at the former grain storage facility prior to purchase by the current owner. During the 1960's when there were large grain crop surpluses, extensive amounts of grain were stored for long periods of time while waiting for market. Fumigants were used on the grain in an effort to keep the grain in good condition. A primary ingredient of the liquid grain fumigants that were used in the 1960's and 1970's was CCl_4. The presence of volatile organic compounds in the ground water downgradient from the former grain storage facility is consistent with liquid fumigants, having been released into the soil at the former grain storage facility, migrating downward and entering the ground water.

TABLE 2
Range of Concentrations of Volatile Organic Compounds
City of Hastings, Nebraska
1985-1989
Municipal Wells
Concentration in micrograms per liter (ug/l).

PARAMETER	M-3	M-6	M-9	M-10	M-11	*M-20
Carbon Tetrachloride (CCl_4)	22.0 - 32.0	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene (DCE)	ND	ND	ND	ND	ND	ND
Trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene (Total)	ND	ND	ND	ND	ND	ND
Tetrachloroethene (PCE)	ND	ND	ND	ND	ND	ND
Trichloroethylene (TCE)	ND	ND	ND	ND - 21.0	ND - 2.0	ND - 5.0
1,1,1-Trichloroethane (TCA)	ND	ND	ND	ND - 0.3	ND	ND
Ethylene Dibromide (EDB)	NA	ND	ND	NA	ND	ND

*M-20 is a new well constructed in 1987 and initially sampled by the EPA in May, 1988.

NOTES:

- Ground water data presented here reflects data found in M-3 and M-10 which have since been taken out of regular service and/or decommissioned. CCl_4 concentrations were higher when these wells were in service.
- NA - parameter not analyzed.
  ND - compound not detected.
- Data were obtained from the REM II - Ground Water Evaluation, Hastings Groundwater Contamination Site, Hastings, Nebraska, May 7, 1987; and from EPA laboratory reports.
- The above analyses were reported by EPA Labs and EPA Contract Labs.

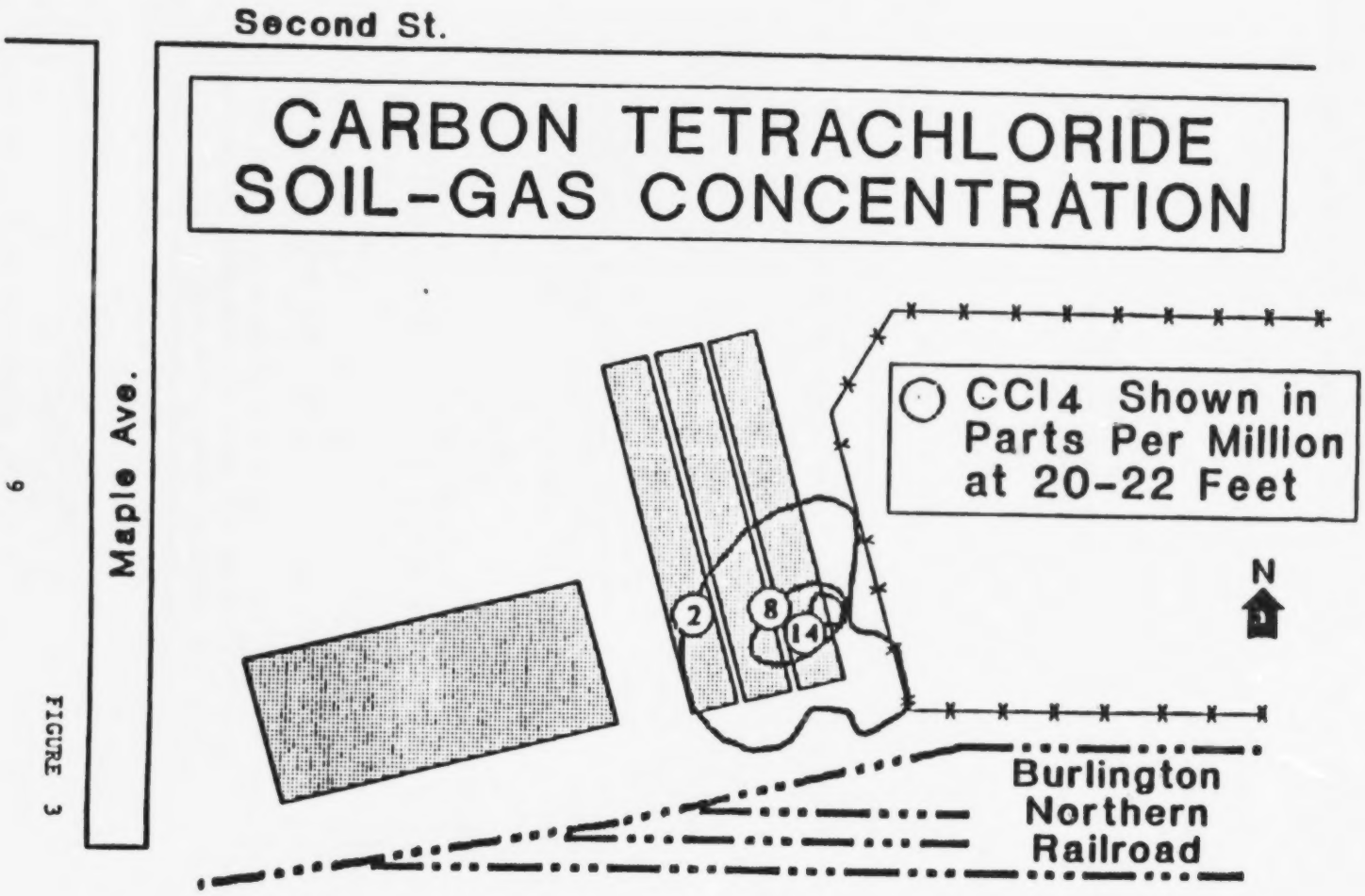

Second St.
CARBON TETRACHLORIDE
SOIL-GAS CONCENTRATION
Maple Ave.
CCl4 Shown in
Parts Per Million
at 20-22 Feet
N
2
8
14
Burlington
Northern
Railroad

FIGURE 3

An Engineering Evaluations and Cost Analysis for an Expedited Response Action for Soil and Soil Gas Well Number 3 Subsite (EE/CA) dated July 24, 1989 was released by EPA for public comment on July 31, 1989. The public comment period for this subsite was closed on August 28, 1989. The EPA has prepared a responsiveness summary which addresses the comments received (Attachment A).

The EPA has no information indicating that hazardous substances were ever generated at the site. Therefore, no onsite burial of wastes is suspected.

Public access to the subsite is not restricted at this time; however, the owner of the subsite has been advised by EPA that precautions should be taken when response activities are underway so that soils that might be contaminated are not disturbed.

ENFORCEMENT HISTORY

History of this site indicates that this property was leased to the Farmers Grain Storage, Inc. in the 1960's and later sold to its current owner, W.G. Pauley Lumber Co. in 1975. Information request letters were sent to W.G. Pauley Lumber Co. and one of the past owners to determine use of grain fumigants at the site. The current owner uses the former grain storage buildings as warehouses for lumber. It has been determined, through EPA's investigation, that CCl_4 was used by Farmers Grain Storage, Inc. Additional information requests are being prepared for former shareholders of Farmers Grain Storage, Inc. to further determine, among other things, the past use of CCl_4 and chloroform at this site. Farmers Grain Storage, Inc., was dissolved in 1978 and no successor corporations are known to exist. The investigation of potentially responsible parties (PRPs) is ongoing; EPA has not yet notified anyone of their PRP status at this subsite.

COMMUNITY RELATIONS

Community relations activities for the Hastings Ground Water Contamination site were initiated by the EPA in 1984 with the development of a Community Relations Plan. Since December 1984, EPA has conducted meetings periodically with Hastings city officials to update them regarding site work and findings.

The EPA Region VII Public Affairs Office has written several Fact Sheets and provided them to parties who have expressed an interest in the Hastings Ground Water Contamination Site. The public affairs office also responds to inquiries from news media and members of the public regarding this site. The most recent Fact Sheet was prepared in July, 1989.

A public meeting was held on August 10, 1989 to provide the public an opportunity to comment on the EE/CA. Concerns regarding the environmental impacts of contamination and the relative merits of alternative response actions were voiced. A responsiveness summary, which addresses the comments and questions raised, is attached to this ROD as Attachment A. This summary also addresses comments made during the course of the remedial investigation.

SITE CHARACTERISTICS

Investigations conducted by EPA during 1987-1989 show that the highest levels of CCl_4 contamination in the soils and soil-gas occur in the area defined by the soil-gas contours illustrated in Figure 3, which depicts the levels of CCl_4 contamination in shallow borings at depths of 20-22 feet. Figure 3 also indicates that the CCl_4 contamination is concentrated within a small area near the outside wall of the eastern warehouse at the subsite. The highest CCl_4 concentration in deep borings, as indicated by Figure 5, is 1200 parts per million by volume (ppmv), found at a depth of 110 feet.

Data presented in the EE/CA also show high levels of CCl_4 and chloroform in the ground water at the subsite. As indicated in Table 4, analyses of samples taken from CW-1, the monitoring well installed at the subsite, revealed the presence of CCl_4 at levels ranging from 110 parts per billion (ppb) to 270 ppb and chloroform ranging from non-detect to 68 ppb. These samples confirmed the results from borehole water samples taken during the remedial investigation which indicated the presence of CCl_4 and chloroform.

Pursuant to the authority of the Safe Drinking Water Act (SDWA), 42 USC §300(g), EPA has established a Maximum Contaminant Level (MCL) for CCl_4. MCL refers to the maximum permissible level of a contaminant in water which is delivered to any user of a public water system. The MCL of 5 ppb has been established for CCl_4. As indicated in this document, the MCL for CCl_4 has been exceeded. The MCL for chloroform is 100 ppb; analyses of samples collected indicate this MCL has not been exceeded.

CCl_4 and chloroform, as members of the volatile organic compounds (VOC) family, readily form vapors because of their low boiling points. These vapors move through soil by the processes of diffusion and dispersion. VOC's have a tendency to migrate through porous regions. Due to their density and to gravitational effects, these VOCs will move through deeper soils and then enter ground water. When a sufficient concentration of CCl_4 and chloroform are present, phase separation will occur and the pure liquid will tend to be located in the lower regions of the aquifer or above clay lenses, if such lenses are present. Because these natural processes of diffusion and dispersion are continuous, as long as the CCl_4 and chloroform remain in the soil-gas, they will continue to move through the soil and into

the ground water.

The continuous movement of the CCl_4 is indicated by the data. For example, prior to the decommissioning of public supply well M-3 in 1985, CCl_4 was present in M-3 at a concentration ranging from 27 to 46 ppb. Since M-3 was taken out of service and is no longer drawing CCl_4 from the source area, the presence of CCl_4 has been noted in MW-23, a downgradient monitoring well.

CCl_4 and chloroform have been classified by EPA as probable human carcinogens, based on animal studies. The potential for carcinogenic risks is evaluated by estimating excess lifetime cancer risks, that is, the incremental increase in probability of developing cancer during one's lifetime, generally 70 years, compared to the probability of getting cancer where there is no exposure to contaminants. Based on the highest detected concentration of CCl_4 and chloroform found in the ground water sampled onsite at CW-1, the excess lifetime cancer risk for a person who ingests two liters of such water per day for a lifetime of 70 years is 3×10^{-3} which is greater than 1 increased cancer case in an exposed population of 1000. See Table 5.

The level of CCl_4 contamination present in the ground water and in soil gas above the water table necessitates a response action at the Well Number 3 subsite to reduce the potential risks to human health and to reduce further significant releases of contaminants to the sole source aquifer.

Ground Water Contamination

Ground water at the subsite is found at a depth of approximately 120 feet. The subsite is underlain by a sand and gravel aquifer, having a saturated zone approximately 100 feet in depth. This aquifer is the sole source of drinking water and is used extensively for industrial and irrigation purposes. The lateral flow in the aquifer has been found to be generally eastward from the subsite. However, the potentiometric surface map of the area indicates the direction of flow east of the subsite is influenced by the regional east-southeast gradient. The sand and gravel aquifer is underlain by thick deposits of clay and shale. Depths to the clay/shale formations range from 200-220 feet.

Analyses of samples from Well M-3, taken between 1983 and 1985, have shown CCl_4 contamination (Table 3). M-3 is approximately 4,500 feet downgradient from the source area.

TABLE 3

Range of Concentrations of Volatile Organic Compounds in Ground Water WELL NUMBER 3, Hastings, Nebraska 1983-1985

Concentrations in micrograms per liter (ug/l)

Parameter	4/83	5/83	4/85	9/85	12/85
CCl_4	27.1	31-46	22	26	32
Chloroform	ND	ND	ND	ND	ND

Notes

- Data were obtained from the REM II Ground Water Investigation Report for Hastings Ground Water Contamination, May 7, 1987, and quarterly ground water sampling data
- M-3 is located 4,500 feet east of the former grain storage facility
- Key: ND - not detected

In addition to the contaminants of concern, trichloroethylene (TCE) also has been detected in the ground water at this subsite. TCE is a contaminant of concern at other portions of the Hastings Ground Water Contamination Site, but it was not detected in the soils or soil-gas samples taken at the Well Number 3 source area.

Ground water samples were collected from the monitoring well located at the subsite (CW-1) and from monitoring wells located downgradient from the subsite. The highest detected contaminant concentrations of CCl_4 and chloroform were seen at well CW-1 which is screened in the shallow portion of the aquifer (120-140 ft.). As indicated in Table 4, CCl_4 is present not only in the ground water onsite, but is also present in monitoring well MW-23 downgradient from the subsite. Table 4 also indicates that CCl_4 is not present in MW-12, a well northeast of the source area. Table 1 indicates CCl_4 is not present in public supply wells M-6, M-10, M-9 and M-11, which are downgradient of the source area.

TABLE 4

Range of Concentrations of Volatile Organic Compounds
City of Hastings, Nebraska
1986-1989
EPA Monitoring Wells
Concentration in micrograms per liter (ug/l).

PARAMETER	MW-3	MW-11	MW-12	MW-23	CW-1
CCl_4	ND	ND - 3.0 M	ND	ND - 8.0	110.0 - 270.0
Chloroform	ND -	ND	ND	ND	ND - 68.0
1,1-Dichloroethene (DCE)	ND	ND	ND	ND	ND
Trans-1,2-Dichloroethene	ND	NA	NA	NA	NA
1,2-Dichloroethene (Total)	NA	ND	ND	ND	ND - 7.0
Tetrachloroethene (PCE)	ND - 4.0 M	ND	ND	ND - 3.0 M	ND
Trichloroethylene (TCE)	81.0 - 130.0	ND - 11.0	ND - 7.0	ND - 70.0	ND
1,1,1-Trichloroethane (TCA)	ND	ND	ND	ND	ND
Ethylene Dibromide (EDB)	NA	NA	NA	ND	ND - 0.088

NOTES:

- Ground water data presented here for well MW-3 reflects data collected from 1986 to 1989. Ground water data presented for wells MW-11, MW-12, MW-23 and CW-1 were collected during 1988 and 1989.
- M - the value indicated is below the quantification limit but above the detection limit.
  NA - parameter not analyzed.
  ND - compound not detected.
- Data were obtained from the REM II - Ground Water Evaluation, Hastings Groundwater Contamination Site, Hastings, Nebraska, May 7, 1987; and from EPA laboratory reports.
- The above analyses were reported by EPA Labs and EPA Contract Labs.
- EDB reported in CW-1 was not confirmed in June, 1989 re-sampling

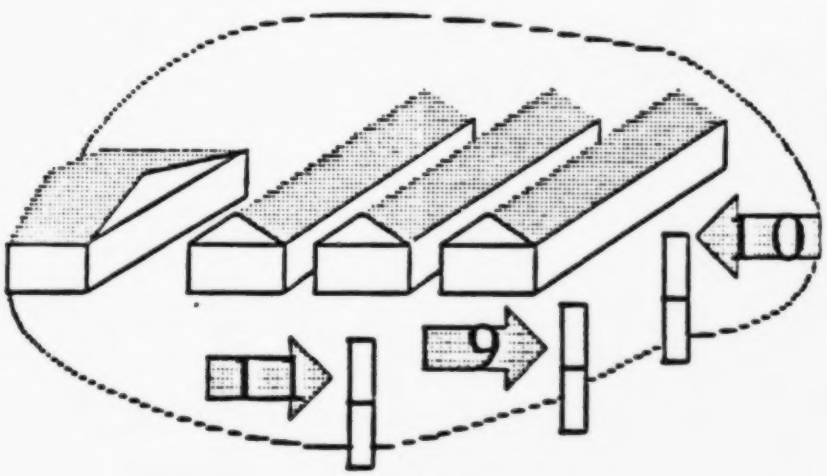
Soil and Soil-Gas Contamination

Soil sampling and soil-gas sampling were performed in 1988 and 1989 in order to better define zones with the highest concentration of volatiles in the soils. Results of this sampling, which is reported in the EE/CA, showed high levels of contamination in the soil-gas and localized areas of contamination. Figure 3 depicts the area where the highest levels of CCl_4 in soil-gas have been detected. The action selected in this document will reduce the potential for future releases of CCl_4 and chloroform to the ground water by removing the CCl_4 and chloroform from the unsaturated zone above the ground water.

The results of the soil-gas analyses located the highest levels of contamination at a depth of 80 to 120 feet (Figures 4 and 5), which is in the unsaturated zone directly above the water table. Historical data indicates that the water table level has receded 20 feet in the past 20 years. The contamination is therefore located in an area that was once an aquifer which produced large volumes of water.

FIGURE 4

SOIL-GAS SAMPLING LOCATIONS WELL NUMBER 3 SUBSITE



SAMPLING RESULTS
Well No. 3 Subsite
CCl_4 in Soil-Gas (ppm)

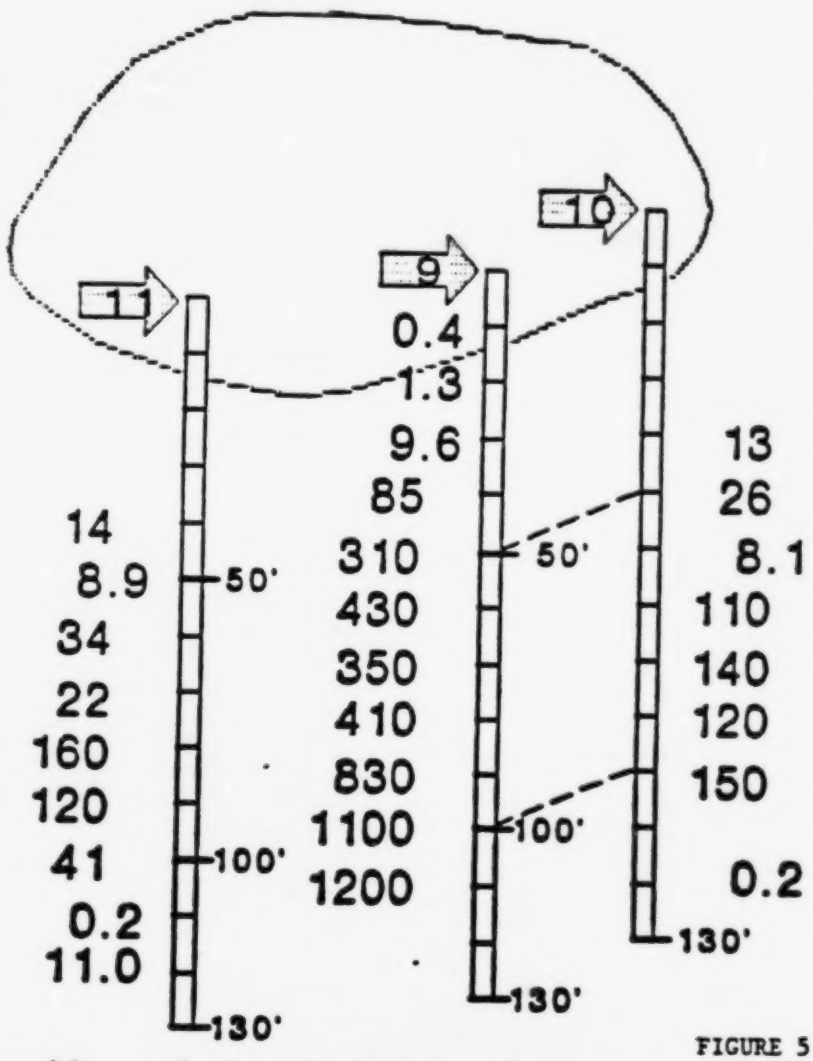


FIGURE 5

Depth of borings shown in feet

The levels of CCl_4 in soil-gas, as shown in Figure 5, pose a potential health threat to users of ground water downgradient from the source area.

RISK ASSESSMENT

A risk assessment has been conducted for two purposes:

1. to determine the likelihood that people who are exposed to CCl_4 and chloroform known to be present at the subsite will be adversely affected by that exposure; and

2. to characterize the nature of the effects such persons may experience from exposure.

The risk assessment consisted of the evaluation of the toxic properties of CCl_4 and chloroform and the conditions of human exposure to them. This risk assessment has been based only on exposure to the contaminants of concern and has not taken into account other factors such as genetics, lifestyle habits, and other environmental exposures.

Exposure Pathways

The likelihood of human exposure to high levels of CCl_4 and chloroform contained within the soil-gas at the subsite is remote as the high levels of these contaminants are located 40 feet below the surface, depths greater than would normally be encountered during typical excavation activities. Any risks associated with human exposure to low levels of CCl_4 and chloroform contained in the surface soils at the subsite is likely to be minimal due to the dilution of the contaminants when in contact with the atmosphere.

In contrast, the potential exposure pathways associated with ground water contamination does present a potential threat to human health. Potential exposure pathways include ingestion of ground water, direct dermal contact with ground water, and inhalation of contaminants released during use of contaminated ground water. Persons potentially at risk of exposure to the contaminants in ground water include users of private and industrial wells downgradient from the site and customers who depend on the public water supply within the City of Hastings.

Carcinogenic Effects of CCl_4 and Chloroform

As discussed earlier in this document, the contaminants of concern, CCl_4 and chloroform, have been identified by EPA as probable human carcinogens, which, if ingested daily in high enough doses over a lifetime, could elevate a person's cancer risk. Excess lifetime cancer risks are determined by multiplying the intake level by the cancer potency factor which is the quantitative estimate of cancer risk due to ingestion of water. These risks are probabilities that are generally expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a plausible upper limit, an

individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

An assessment has been done of the risk associated with ingestion by a 70 kilogram adult of two liters of water on a daily basis over a lifetime of 70 years from CW-1, the contaminated well at the subsite. The results of this baseline risk assessment indicate that the risk of cancer to those who ingest CW-1 well water, using the above-stated assumptions (2 liters /day /70kg /70 years), is approximately : 3 additional cancers in a population of 1000 for CCl_4; 2 additional cancers in a population of 100,000 for chloroform. This risk exceeds the risk range that EPA considers protective of human health. Extrapolations from animal studies indicate that the liver is the organ at risk for developing cancer as a result of ingesting CCl_4 or chloroform, assuming 2 liters/day/70 kg/70years.

TABLE 5
Health Assessment Based on CW-1 Water Ingestion Exposure
Excess Lifetime Cancer Risk

Chemical	EPA Carcinogen Classification	Carcinogenic Potency Factor (mg/kg/day)	Highest Detected Concentration (ppb)	Excess Lifetime Cancer Risk
CCl_4	B2	0.13	700	3×10^{-3}
Chloroform	B2	0.0061	120	2×10^{-5}
Overall				3×10^{-3}

Notes: EPA's carcinogen classification scheme:
B2 = Probable human carcinogen on the basis of animal data

Source: Table 2-4, EE/CA for an Expedited Response Action for Soil and Soil Gas Well Number 3 Subsite, July 24, 1989 citing Superfund Public Health Evaluation Manual, U.S. EPA, 1986 and the Integrated Risk Information System (IRIS), U.S. EPA, 1988. IRIS is a catalog of risk assessment and risk management information designed especially for federal, state and local environmental health agencies as a source of the latest information about Agency health assessments and regulatory decisions for specific chemicals.

Noncarcinogenic Effects of CCl_4 and Chloroform

An assessment has also been done of the noncarcinogenic risks associated with ingestion of these contaminants. Noncarcinogenic risk is determined by comparing the daily intake of the contaminants to their reference dose (RfD), which is an estimate of the daily exposure to the human population that is likely to be without appreciable risk of harmful effects during a lifetime. RfDs are reference points for gauging potential effects of other doses. Therefore, doses less than RfDs are not likely to be associated with any health risks but a clear conclusion cannot be drawn that all doses below the RfDs are acceptable and that all doses above the RfDs are unacceptable. RfDs are expressed in units of milligram per kilogram per day. Estimated intakes of the contaminants, if ingested from the ground water, can be compared to the RfDs. RfDs are derived from human epidemiological studies or animal studies, to which uncertainty factors have been applied. These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur. Table 6 indicates RfDs for CCl_4 and chloroform.

TABLE 6
Reference Dose milligrams per kilograms per day
Water from CW-1

COMPOUND	Critical Effect	Highest Level	Hazard Index	RfD
CCl_4	Liver lesions	270 ug/l	11.0	0.007
Chloroform	Fatty cyst formations in liver	68 ug/l	0.196	0.01

Hazard Index is the daily intake divided by the reference dose. A hazard index value greater than 1 indicates a potential human health risk.

Environmental Risks

No threatened or endangered species or critical habitats have been identified in or near the site. However, there is a potential threat to the environment and to wildlife if source control measures are not taken to prevent the release of the contaminants into the ground water.

Conclusion

Because of the carcinogenic and noncarcinogenic risks to human health associated with ingestion of ground water contaminated with chloroform and CCl_4 at the levels found onsite in CW-1, response action alternatives were developed to reduce the potential for human exposure to contaminated ground water. This response action selected will minimize the volume of contaminated ground water which will migrate from the Well Number 3 subsite.

SCOPE OF OPERABLE UNIT

This response action is an interim source control operable unit and is consistent to the maximum extent practicable with Section 300.68(c) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This interim source control operable unit is being implemented to protect public health and the environment by controlling the migration and reducing the volume of contaminants from the subsoils to the ground water. The operable unit addresses known areas of contamination in the sands and silts which overlie the aquifer. Future actions may involve expansion of the response action or modification in the design of the system being used. Based upon EPA's investigations, the operable unit contains approximately 400 pounds of VOC's. This area is shown on Figures 3 and 5.

This interim action, by reducing the volume and controlling the migration of contaminants, is fully consistent with all future site work, including the ongoing ground water investigations at the Hastings site. In addition, this action will affect the costs of the final remedy by limiting the amount of ground water that is likely to become contaminated from this source.

The following are the key milestones for implementation of the response action:

Approve Response Action (Execute ROD)	September 1989
Initiate Response Design (Funding)	November 1989
Initiate Response Action (Operational Testing)	April 1990

SUMMARY OF ALTERNATIVES

Response alternatives have been developed in order to meet the objectives of CERCLA and, to the maximum extent practicable, the NCP. The process used to evaluate alternatives for this site is detailed in the EE/CA and is addressed briefly here.

The first step in the evaluation of alternatives was to investigate technologies and determine which technologies may be feasible. The technologies were then screened based on effectiveness, implementability, and overall comparative cost. The technologies that are applicable to the response action at the subsite were then evaluated individually.

Based on this initial screening, response action alternatives were identified for development and evaluation of their ability to meet environmental laws and standards. This interim action will be consistent with Section 121 (d) of CERCLA which requires that remedial actions comply with applicable or relevant and appropriate requirements or standards (ARARs) under Federal and State environmental laws. Two of 3 alternatives presented win the EE/CA in addition to the No Action alternative

were further evaluated.

EVALUATION OF ALTERNATIVES

CERCLA and the NCP require that each alternative developed, including the no-action alternative, be evaluated with respect to two major criteria: overall protection of human health and the environment and compliance with applicable or relevant and appropriate environmental requirements. Seven additional criteria are considered as a means to compare the alternatives. These include:

- Long-term effectiveness;
- Reduction of toxicity, mobility or volume;
- Short-term effectiveness;
- Implementability;
- Cost;
- State acceptance; and
- Community acceptance.

Each alternative must be evaluated for the degree of onsite and offsite protection required (and thus, to be provided) by the actions involved, as part of the overall effectiveness.

Since this response action is an interim measure, two alternatives will be compared and evaluated. These are, in addition to the No-Action Alternative, Soil-Vapor Extraction with Granular Activated Carbon Treatment of Air Emissions and Soil-Vapor Extraction with incineration of air emissions.

No-Action Alternative

The Agency has evaluated the no-action alternative for source control. If the no-action alternative were selected, it would be necessary to closely monitor the downgradient wells of the public water supply system. This monitoring would identify the wells with water that exceed the MCLs, but would not prevent continued migration and would not assure availability of alternate water supplies to users. Based on downgradient water quality data and the high levels of contamination in the soil-gas, the no-action alternative would not reduce migration of contaminants and may permit the level of risk to increase due to the amount of contamination present in the soils. Consequently, neither on-site nor off-site protection would be achieved by this alternative.

Another reason the no-action alternative is not viable is that the long-term reliability of monitoring would decrease with the passage of time and with distance from the site. In addition, there would be no reduction of mobility, toxicity or volume; therefore, the no-action alternative would create the highest likelihood for future releases of hazardous substances to the environment. Because hazardous substances are known to exist in the soil-gas above the aquifer, the no-action alternative

would not protect the ground water from further degradation.

Short-term costs associated with the no-action alternative relate to the costs of monitoring the drinking water supply system in Hastings. The frequency of this monitoring would depend on the level of contamination found, with increased frequency where high levels are found in the public supply system. Additional wells would have to be installed in order to properly monitor the movement of the plume. Further investigations would be required to determine proper placement of wells. Alternate water supply systems would have to be installed or alternate treatment technologies would have to be implemented in the case of high levels of contamination.

In-Situ Soil Vapor Extraction(SVE) and Treatment by Vapor Phase Granular Activated Carbon (GAC) Adsorption

This alternative involves removing the contamination from the soil-gas without excavation and subsequently treating the vapor. This alternative would provide permanent removal and destruction of contaminants from the soil-gas and, thereby, achieve a reduction in mobility, toxicity and volume of contaminants and impede their movement to the ground water. Human health and the environment would be protected both on-site and off-site to the extent that this response action would prevent the spread of further contamination into the ground water. Further, as part of the SVE process, the air emissions would be controlled.

A vapor extraction system enables VOCs to be removed from the soil-gas by applying a vacuum and using a conventional industrial blower and standard valving, piping and instrumentation. This equipment is readily available, thus the SVE is an implementable response action. Vacuum extraction has been used successfully in full-scale operations for removing many types of VOCs found in soils ranging from fine-grained silts to coarse-grained sand and gravels. This alternative proposes that the extracted vapor would be treated by a vapor phase activated carbon system, if significant air emissions were to result from implementation of this response alternative. The GAC filters would be replaced, if necessary, and "spent" carbon would be transported off-site to an approved treatment facility for regeneration or incineration (if regeneration is not available). Any liquid generated from the soil vapor process would also be treated with GAC. These liquids would be disposed on-site when the MCLs for CCl_4 and chloroform are reached.

The need for direct action was stressed in public comments submitted to the Agency. This alternative is acceptable to the community. The EPA and the state of Nebraska prefer the less costly action alternative.

One of the characteristics of the SVE process is that it immediately withdraws the contaminants. This response action would therefore provide both short-term and long-term effectiveness.

An engineering calculation for the capital costs for this response action was estimated to be $874,000, based upon a gas extraction system of 19 extraction wells. The first year operation and maintenance costs were $154,000. Details of this calculation are set forth in the EE/CA.

Applicable, Appropriate, and Relevant Requirements (ARARs)

Regulations governing the transportation of hazardous materials are applicable, relevant and appropriate to this interim action. Therefore, transportation of the "spent" carbon offsite will be done in compliance with regulations found in 49 CFR Part 107 promulgated pursuant to The Hazardous Materials Transportation Act, 49 U.S.C. §1801 et. seq.

It is possible that the carbon used in the SVE system and the subsequent treatment of the air emissions would become contaminated, requiring its disposal as a hazardous waste. Regulations governing the disposal of hazardous wastes are therefore applicable, relevant, and appropriate. Disposal would be in compliance with Sections 3002, 3003 and 3004 of the Resource Conservation and Recovery Act, as amended (RCRA), 42 U.S.C. §6922, §6923, and §6924 and the regulations found at 40 CFR Parts 262, 263, and 264. These statutes and regulations govern the standards applicable to generators, transporters, and owners and operators of hazardous waste treatment, storage, and disposal facilities. These regulations require, among other things, proper recordkeeping, reporting, and management of hazardous wastes. Disposal of the "spent" carbon would also be consistent with EPA's off-site policy which requires that hazardous wastes disposed off-site as part of a remedial action would be taken to a facility in compliance with RCRA.

The Occupational Safety and Health Act (OSHA), 29 USC §651 et. seq., is legally applicable to this interim action. This law regulates worker health and safety in the work place. The regulations found at 20 CFR Part 1910 et. seq. are relevant to this response action. These regulations protect health and safety of workers at hazardous waste sites performing remedial actions.

Estimated Time for Implementation

It is estimated that an SVE system could be implemented at this subsite within 9 to 18 months.

Treatment Goal

The goal of the SVE implementation is to remove the VOCs known to be contained in the soil-gas directly above the aquifer. The current engineering estimate of 400 pounds of VOCs in the soil-gas at the sub-site contains uncertainty. Monitoring of the SVE system for VOC removal and monitoring of the soil-gas within the unsaturated zone above the aquifer will direct the implementation and will determine the duration of the response action.

In-Situ Soil Vapor Extraction and Treatment by Incineration

This alternative involves removing the contamination from the soils and treating the vapor. This alternative is similar in design to the second alternative except that the vapor phase emissions would be treated using incineration instead of GAC. Incineration is a proven technology for treating VOC emissions. An incinerator consists of a refractory-lined vertical cylindrical vessel containing a bed of inert, granular materials. Air is injected at the bottom of the vessel through a distributor plate. Contaminated gases are injected above the bed. Auxiliary fuel is also injected at this point. This equipment, while costly, is readily available and therefore this response action is implementable. This alternative would provide permanent removal and destruction of contaminants and achieve a reduction in mobility, toxicity and volume. Human health and the environment would be protected both on-site and off-site to the extent that this response action would prevent the spread of further contamination into the ground water. Further, as part of the SVE process, the air emissions would be controlled. Incineration could achieve an overall VOC removal efficiency of over 99 percent if operating temperatures of 1880^{o}F are achieved. Pilot tests would be conducted for system design that would achieve the level of destruction required at this site.

The need for direct action was stressed in public comments submitted to the Agency. This alternative is acceptable to the community. The EPA and the State of Nebraska prefer the less costly action alternative.

One of the characteristics of the SVE process is that it immediately withdraws the contaminants. This response action would therefore provide both short-term and long-term effectiveness.

An engineering calculation for the capital costs for this response action was estimated to be $954,000, based upon a gas extraction system of 19 extraction wells. The first year estimated operation and maintenance costs were estimated to be $213,000. Details of this calculation are set forth in the EE/CA.

Applicable, Appropriate, and Relevant Requirements (ARARs)

The Occupational Safety and Health Act (OSHA), 29 USC §651 et. seq., is legally applicable to this interim action. This law regulates worker health and safety in the work place. The regulations found at 20 CFR Part 1910 et. seq. are relevant to this response action. These regulations protect health and safety of workers at hazardous waste sites performing remedial actions.

Since the SVE process will capture the contaminants within the soil-gas, the air to be burned within the incinerator will contain hazardous waste, as defined in the RCRA regulations, 40 CFR Part 261 "Identification and Listing of Hazardous Waste." Pursuant to Nebraska Environmental Protection Act Section 81-1501 et. seq. regulations were promulgated. These regulations found at Chapter 16 of Title 128 adopted RCRA regulations found in 40 CFR Part 264 Subparts O Sections 264.340 through 264.351 concerning the proper operation of incinerators and are legally applicable.

Estimated Time for Implementation

It is estimated that an SVE system could be implemented at this subsite within 9 to 18 months.

Treatment Goal

The goal of the SVE implementation is to remove the VOCs known to be contained in the soil-gas directly above the aquifer. The current engineering estimate of 400 pounds of VOCs in the soil-gas at the sub-site contains uncertainty. Monitoring of the SVE system for VOC removal and monitoring of the soil-gas within the unsaturated zone above the aquifer will direct the implementation and will determine the duration of the response action.

COMPARISON OF ALTERNATIVES

The no-action alternative is not a viable option because it is not protective of human health and the environment. Of the two action alternatives, both are protective of human health and environment. Both are implementable; both would reduce toxicity, mobility and volume of contaminants. The effectiveness of both alternatives, short-term and long-term, are equal. The degree of on-site and off-site protection is the same for both alternatives. Both action alternatives are acceptable to the community of Hastings. However, the only significant distinction between the two action alternatives is cost effectiveness the SVE alternative that utilizes GAC emission control is more cost effective. The EPA and the state of Nebraska prefer the more cost effective alternative.

Cost comparison data is shown in Table 7. These estimates were based upon engineering judgments regarding implementability. Clearly, soil vapor extraction using GAC is the more cost-effective of the action alternatives.

Soil vapor extraction using GAC is also more cost-effective as compared to the no-action alternative. By removing the potential source of ground water contamination, the costs associated with recovery and treatment of the contaminated ground water are significantly reduced. Delay of source control action will magnify the ground water contamination problem and thereby cause total response action costs for this site to increase.

TABLE 7
COST COMPARISON OF RESPONSE ACTION ALTERNATIVES
FOR CONTAMINATED SOIL GAS
WELL NUMBER 3 SITE
($ X 1,000)

Alternative	Total Capital Cost(a,d)	First Year O&M Cost (b,c)
No Action	NA(e)	NA
In-Situ Soil Vapor Extraction and Treatment by Vapor Phase Carbon Adsorption	874	154
In-Situ Soil Vapor Extraction and Treatment by Incineration	954	213

Notes:
(a) Estimate includes gas extraction system, air treatment system, engineering design, construction management and other contingency costs.

(b) Estimates include power costs, maintenance, labor, monitoring of air and soils and contingency costs.

(c) For cost comparisons of alternatives, one year of operation is assumed.

(d) Cost estimate based on the installation of a system with 19 extraction wells. A system with fewer wells would be expected to cost less.

(e) Cost estimates need to be developed for the long term monitoring required, if this alternative is selected.

SELECTED ALTERNATIVE

Based on available data and analysis conducted to date, the EPA selected soil vapor extraction with GAC vapor treatment as the most appropriate solution for meeting the goals of the source control operable unit at the Well Number 3 subsite. The characteristics of SVE that are considered most important are:

- The alternative provides protection to human health and the environment from the potential threats associated with no action;
- The alternative limits migration of contaminants to the aquifer at the site;
- The alternative provides for compliance with applicable laws and regulations; and
- The alternative is consistent with additional site actions and will be compatible with the final site remedy.

The Regional Administrator retains the authority to make changes in the scope and nature of source control actions to be undertaken at this site. If new information or additional environmental data warrants a change, then the impacts of the suggested change will be reviewed to determine if any significant departure from the selected alternative does in fact exist. Cost impact of any proposed changes will be taken into account.

The design of the system will include a review of the data produced by the Colorado Avenue Soil Vapor Extraction (SVE) pilot. If needed, other data collection activities could be incorporated into the design. Examples of necessary design data could include the following:

1. Rate of gas withdrawal and air recharge;
2. Information to properly size the vacuum/air withdrawal system components;
3. Radius of influence and other information to design the final gas extraction well network;
4. Calculations of air emissions resulting from the soil vapor extraction process;
5. Information to demonstrate the capability to control air emissions and determine whether or not air monitoring would be required during the cleanup phase;
6. Information to select and design the most cost effective system for air emissions treatment; and
7. Information to design the gas monitoring well network.

CLEAN-UP LEVELS

This interim action is being implemented for the purpose of controlling contaminant migration, not restoration of the aquifer to drinking water standards. Therefore, no cleanup levels are being established at this time. The vapor extraction system will initially operate under controlled conditions to provide for collection and analysis of operational data. The data will be used to refine final design information and to establish effectiveness of the vapor extraction system. Cleanup effectiveness will be evaluated based on volume of contaminants recovered from the soils. Review and decision-making regarding cleanup levels will be closely coordinated with the state of Nebraska. Since the potential threat existing at the site is related to inhalation and ingestion of contaminated drinking water rather than from a direct contact threat, the clean up levels for soil and ground water can be addressed later.

As previously stated, recovery of volatiles by SVE will be less costly than treating large volumes of contaminated ground water at a future date. Therefore, the volume of volatile contaminants recovered will be one measure of success of the selected remedy. Ground water monitoring is expected to show a decreased concentration of contaminated ground water migrating from the site. These monitoring data will be direct measures of success of the selected remedy. The anticipated result is that the duration of any long-term actions will be decreased by this remedy.

OPERATION AND MAINTENANCE

The recommended alternative requires a certain degree of annual operation and maintenance (O&M) activity to ensure proper operation of the system and compliance with environmental laws and regulations. The costs of O&M will depend on volume of contaminants recovered and the size of the completed vapor extraction system. An O&M plan will be developed during design of the system after the initial phase of operation and testing.

A ground water monitoring plan will also need to be developed and implemented to demonstrate reduced migration of contaminants in the ground water.

FUTURE ACTION

Ground water monitoring wells downgradient from the site will continue to be sampled and a technical approach for plume management will be developed. Agency decision-making regarding ground water treatment will be discussed with the state of Nebraska prior to preparation of a Record of Decision for ground water treatment.

STATE ROLE

The state of Nebraska's Department of Environmental Control has reviewed the various alternatives and has indicated its concurrence with the selected action. The state has also reviewed the EE/CA and concurs with the selected action for the Well Number 3 Subsite of the Hastings Ground Water Contamination Site.